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THE RESULTS OF A SURVEY OF TRAVEL BY EPA EMPLOYEES ON APRIL 19, 1976

OFFICE OF POLICY ANALYSIS
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

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THE RESULTS OF A SURVEY OF TRAVEL BY EPA EMPLOYEES ON APRIL 19, 1976

by

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WASHINGTON, D.C.

NOVEMBER 1976

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ABSTRACT

It is sometimes suggested that the intensity of smog episodes in the Washington, D. C. area could be reduced by asking Federal employees in the area not to go to work on days forecast to be smoggy, thereby reducing the volumes of automobile travel and emissions during smog episodes. Estimates of the reduction in automobile travel that might be achieved by declaring a Federal "smog day" have been difficult to develop owing to a lack of travel data for situations analogous to smog days. A somewhat analogous situation occurred at EPA on April 19, 1976. Employees of the West Tower were dismissed from work at 9:30 AM because of a breakdown of the building's air conditioning. A survey of travel by employees dismissed on April 19 was conducted, and the results were used to estimate the trip and VMT reductions that might occur on a smog day. The survey results suggest that declaring a Federal smog day might reduce Federal employee automobile trips by 18 to 42 percent and Federal employee VMT by 37 to 50 percent. It is probably safest to interpret these results as being indicative of travel reductions on an isolated smog day or on the first of a series of smog days.

WOULD DECLARING FEDERAL SMOG DAYS REDUCE AUTOMOBILE TRAVEL IN THE WASHINGTON, D. C. AREA?

by

Joel Horowitz

It is sometimes suggested that the intensity of oxidant episodes in the Washington, D. C. area could be reduced by asking Federal employees in the area not to go to work on days forecast to be smoggy. Proponents of this approach claim that the decrease in hydrocarbon emissions associated with the elimination home-to-work automobile travel by Federal employees would be beneficial to air quality. However, opponents have argued that employees who do not have to go to work might take more shopping, social and recreational trips than they normally do on working days, thereby negating the beneficial effects of decreased home-to-work travel.

The extent to which declaring a Federal "smog day" might decrease automobile travel could be determined empirically if appropriate travel data were available for previous smog days or analogous events. However, there exist no travel data sets for smog days, and reasonable analogies are difficult to find. A smog day would be an unanticipated holiday from work during hot weather. Normal non-working days, such as weekends, legal holidays, and vacation days, are not analogous because they are anticipated. Snow days are not anticipated, but the weather on snow days makes driving difficult or impossible.

An event that is somewhat analogous to the declaration of a smog day occurred at EPA on April 19, 1976. Employees in the West Tower were

dismissed from work at 9:30 AM due to a breakdown of the building's air conditioning. The dismissal was analogous to a smog day in that it was unanticipated, the weather was hot, and it occurred early enough in the day to allow employees time to engage in non-work travel. Thus, it is possible that employees' non-work travel activity on April 19 was similar to the activity that would take place on a smog day. If so, employee's non-work travel on April 19 approximates their total travel on a smog day, and the reduction in employee travel that declaring a smog day would produce can be estimated.

The analogy between the April 19 dismissal and a smog day is not perfect. Employees did have to go to work on April 19, and nobody was advised to avoid driving due to atmospheric or other conditions. Nonetheless, the dismissal is more closely analogous to a smog day than are other non-work days for which travel data are available. Using the dismissal as an analogy, estimates have been developed of the reductions in employee automobile driver trips and vehicle miles traveled (VMT) that might be achieved by declaring a smog day. This paper describes the estimation methodology and results.

Methodology

Data on travel by dismissed employees were obtained by distributing a self-administered, written questionnaire to each of 238 randomly selected West Tower employees. The questionnaire is shown in the appendix. Employees were asked to list the origin location, destination location, and travel mode of each trip they took prior to 6:00 PM on April 19. The 6:00 PM cutoff was established on the hypotheses that employees would be more likely to

answer questions about daytime travel than evening travel and that any unusual travel resulting from the dismissal would have occurred during normal working hours. The questionnaire was not distributed until May 6, roughly three weeks after the dismissal occurred. This late distribution may have biased the survey results owing to the possibility that some employees may have forgotten what trips they took on April 19. If it is assumed that employees who took many trips were more likely to forget than employees who took few trips, then the survey results will tend to overestimate the reduction in travel that might be achieved by declaring a smog day.

The survey results were used to compute the average numbers of automobile driver work trips and 9:30 AM - 6:00 PM non-work trips per employee, and the average work-trip VMT and 9:30 AM - 6:00 PM non-work trip VMT per employee. VMT were computed by assigning the origin and destination of each trip to the appropriate Washington area transportation planning zones and summing the interzonal distances over trips. The interzonal distances were obtained from the Washington Council of Governments and are based on data developed in the 1968 Washington area transportation survey.

Results

Of the 238 questionnaires distributed, 114 were returned, making the response rate 48 percent. The 114 returned questionnaires included 12 invalid responses (i.e., the questionnaire was not completed properly), 12 responses from employees who did not leave work on April 19, and 5 responses from employees who were sick or on annual leave that day. Thus, the survey produced a total of 85 useable responses.

The estimates of average automobile trips and VMT per dismissed employee derived from the survey are shown in Table 1. On the average, employees took 1.15 automobile work trips and 0.89 automobile non-work trips before 6:00 PM. Average VMT were 12.29 miles per employee for work trips and 6.17 miles per employee for non-work trips before 6:00 PM.

The reductions in pre-6:00 PM trips and VMT that would occur on a smog day were estimated from the survey results using the following equation:

$$(1) \quad R = \frac{(HW + X) - NW}{HW + X}$$

where

R = Fractional reduction in trips (VMT)

HW = Home-to-work automobile trips (VMT) per employee on a normal day

X = Pre-6:00 PM non-work automobile trips (VMT) per employee on a normal day

NW = Pre-6:00 PM non-work automobile trips (VMT) per employee on a smog day.

It is assumed that home-to-work travel on April 19 was normal. Thus, HW has the values observed in the survey. Using the presumed analogy between the April 19 dismissal and a smog day, NW is set equal to non-work trips (VMT) observed in the survey.

X was not measured in the survey, and recent estimates of X are not available from other sources. However, a range of likely values of X is easy to develop. The lowest possible value of X is zero. If X = 0, then all non-work automobile trips taken on April 19 by dismissed employees occurred because of the dismissal. A likely upper bound for X is NW. If X=NW, then all non-work trips by dismissed employees would have occurred

TABLE 1 - ESTIMATES OF AVERAGE AUTOMOBILE DRIVER TRIPS AND VMT PER DISMISSED EMPLOYEE

	Mean	Sampling Error[a]
Work Trips	1.15	0.20
Non Work Trips[b]	0.89	0.29
Total Trips	2.04	0.31
Work VMT	12.29	3.20
Non Work VMT[b]	6.17	2.55
Total VMT	18.46	3.92

a. Computed at 95% confidence level

b. Prior to 6:00 PM

even if there had been no dismissal. Another possible value of X can be obtained from the 1968 Washington area transportation survey. In that survey, there were roughly 0.40 automobile trips and 2.5 VMT per government employee prior to 6:00 PM. If X has these values, then 40 percent of dismissed employees' non-work travel on April 19 would have occurred without the dismissal.

The reductions in pre-6:00 PM trips and VMT that might occur on a smog day were estimated using each of the three foregoing values of X. The pre-6:00 PM reductions were converted into reductions in daily trips (VMT) by assuming that the April 19 dismissal did not affect post - 6:00 PM travel. Such travel accounts for about 25 percent of daily travel. The results are shown in Table 2. Depending on the value of X, there is an 18 to 42 percent reduction in trips and a 37 to 50 percent reduction in VMT.

Discussion and Conclusions

The survey results suggest that declaring a Federal smog day might achieve an 18 to 42 percent reduction in automobile driver trips and a 37 to 50 percent reduction in automobile VMT by Federal employees. This conclusion is based on the assumption that the survey results provide a reasonably accurate description of travel behavior under circumstances analogous to a smog day. Some important qualifications to the conclusion will now be discussed.

As explained earlier, the analogy between the April 19 dismissal and a smog day is not perfect. It is not clear *a priori* how this might bias the foregoing conclusion. Not having to go to work on a smog day might cause employees to take more or longer non-work trips than they did on April 19.

TABLE 2 - ESTIMATED REDUCTIONS IN DAILY TRIPS AND VMT ON A SMOG DAY

Assumed Level of Normal Non-Work Travel (X)[a]	Trip Reduction(%)	VMT Reduction (%)
X = 0	18	37
X = NW	42	50
X = 0.40 trips (2.5 VMT) per employee	32	44

a. See page 4 of text for explanation.

However, if exhortations to avoid driving on smoggy days are effective, there might be less non-work travel on a smog day than on April 19.

The late distribution of the survey of April 19 travel is another potential source of bias. As discussed earlier, this may cause the survey's results to overestimate the reductions in travel that would occur on a smog day.

A third potential source of bias is the duration of oxidant episodes in Washington. These episodes typically last for several days, whereas the April 19 dismissal affected only one day. If employees are asked to stay away from work during a series of smog days, their driving patterns may change as the series progresses. For example, they may get restless, with the result that they travel more toward the end of the oxidant episode than toward the beginning. Or they may anticipate the duration of the episode and leave town. It is probably safest to interpret the April 19 results as being indicative of travel on an isolated smog day or on the first of a series of smog days.

ACKNOWLEDGEMENTS

The author thanks Larry R. DeBoever and William G. Laxton for their assistance in developing the survey questionnaire, and David Syskowski and Robert Emslie for helping to compile the survey results.

APPENDIX

The Survey Letter and Questionnaire

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
AIR AND WASTE MANAGEMENT

May 6, 1976

Dear EPA Employee:

On Monday April 19, 1976 employees of the West Tower were released from work at 9:30 A.M. when the air conditioning in the building broke down. The Office of Air and Waste Management would like to acquire information on the automobile trips released employees took that day. The information will be used by OAWM to help determine the extent of emissions reductions that might be achieved if employees were asked not to come to work during smog episodes. The information obtained in the survey will be used for statistical purposes only. No information about individuals will be released. Please do not put your name on the survey form.

The attached questionnaire requests you to supply the addresses of the locations where the trips you took between 9:30 A.M. and 6:00 P.M. on April 19 started and ended. If you do not know an address or would prefer not to provide it, please fill in the street intersection or major landmark nearest the location where your trip started or ended (e.g., 4th & M. Street, S. W., Tyson's Corner, Washington Monument). If you know neither the address nor the intersection nor a landmark, write "don't know." If you did not leave work early, please write "did not leave work" on the form, and return it.

Your participation in this survey is entirely voluntary. If you choose to participate, please return the completed survey form in the attached envelope to Margaret Lee (AW-444) within 48 hours.

Thank you for your cooperation.

Sincerely yours,

Roger Strelow

Roger Strelow
Assistant Administrator
for Air and Waste Management

Enclosures

OAWM SURVEY OF AUTOMOBILE TRAVEL ON APRIL 19, 1976

Your participation in this survey is voluntary. Information obtained from the survey will be used for statistical purposes only. No information about individuals will be released. Do not put your name on the survey form. Please return the completed form in the attached envelope to Margaret Lee (AW-444) within 48 hours.

What is your home address or the street intersection nearest your home, and the city or county and state where you live?

_____

_____

_____

Did you drive a car to work on Monday, April 19, the day the air conditioning broke down?

Yes_____ No_____

Please supply the requested information for each trip you took between 9:30 A.M. and 6:00 P.M. on Monday April 19, the day the air conditioning broke down. Under "Place Trip Started" and "Place Trip Ended" enter the appropriate street address, nearby intersection, or major landmark and the city or county and state.

Trip No.	Place Trip Started	Place Trip Ended	Did you Drive a Car on this Trip?
1	401 M. Street, S. W.		Yes____
	Washington, D. C.		No ____
2			Yes____
			No ____
3			Yes____
			No____

Questionnaire (cont'd)

Trip No.	Place Trip Started	Place Trip Ended	Did You Drive a Car on this Trip?
4			Yes___
			No ___
5			Yes___
			No ___
6			Yes___
			No ___
7			Yes___
			No ___
8			Yes___
			No ___
9			Yes___
			No ___
10			Yes ___
			No ___

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